

MARKSCHEME

November 1999

BIOLOGY

Higher Level

Paper 2

SECTION A

1. (a) *(Award [1 mark] for any of the following)*
(large) fall in dry mass / rise in water content;
little change in content before and after day four / large change on day four; [2]
- (b) (i) day four; [1]
(ii) mass is lost as a result of heat generation;
fall in dry mass due to (respiratory) substrates being used up;
loss of dry mass (partly) due to carbon dioxide given off;
rise in water content (partly) due to production in respiration; [2 max]
- (c) *(Award [1 mark] for any of the following, up to [2 marks])*
accepts electrons;
at the end of the electron transport pathway / chain of carriers;
allows more electrons to pass along the pathway;
water formed from oxygen, electrons and hydrogen ions; [2 max]
- (d) *(Award [1 mark] for any of the following, up to [2 marks])*
increases the rate of respiration;
on all days except the third day / on the days after flowering; [2]
- (e) *(Award [1 mark] for each of the following, up to [2 marks])*
respiration has already been uncoupled;
same / lower respiration rate / oxygen uptake in DNP treated spadices;
on the day of flowering heat is being produced; [2]
- (f) *(Award [1 mark] for any of the following, up to [2 marks])*
external temperature and flower temperature both rise at first;
then later in the day they both fall; [2]
- (g) *(Award [1 mark] for any of the following, up to [4 marks])*
heat generated;
by respiration;
stores / food / dry mass used up (rapidly);
uncoupled respiration;
respiration rate varied to keep temperature (nearly) constant;
(more and) more heat generated as external temperatures fall;
smaller increase after flower temperature has risen;
smaller increase later in night as (presumably) smaller falls in external temperature;
large increases between 17:00 / 18:00 and 21:00;
because of large drops in external temperature; [4 max]

2. (a) *(Award [1 mark] for two or three of the following and [2 marks] for four or five, up to [2 marks])*
Bowman's capsule;
proximal convoluted tubule;
loop of Henle;
distal convoluted tubule;
collecting duct; [2]
- (b) (i) *(Award [1 mark] for the following)*
proximal convoluted tubule; [1]
- (ii) *(Award [1 mark] for any of these, up to [1 mark])*
roots / root hairs;
phloem (sieve tubes in leaves);
guard cells;
other valid answer; [1]
- (c) *(Award [1 mark] for the following, up to [1 mark])*
a measure of the tendency of water to move between regions;
a measure of the free energy of water; [1]
- (d) *(Award [1 mark] for any of these, up to [3 marks])*
mineral ions actively transported into root cells;
solute / mineral ion concentration higher in root cells than in soil solution;
higher water concentration in soil than root;
water potential greater outside root than inside;
water travels across root cell membrane which is semipermeable;
passive movement / no energy / ATP used; [3]
- (e) *(Award [1 mark] for any of the following, up to [3 marks])*
light; temperature; wind; humidity; [3]
3. (a) *(Award [1 mark] for any of the following; up to [2 marks])*
both stimulate the development of the corpus luteum;
both stimulate the secretion of progesterone;
before fertilisation by LH and after by HCG; [2]
- (b) *(Award [1 mark] for any of the following; up to [2 marks])*
(B) lymphocyte obtained that produces the desired antibody;
(B) lymphocyte fused with myeloma / tumour cells;
(hybridoma) cells formed in this way are cultured to produce antibodies; [2]

SECTION B

4. (a) *(Award [1 mark] for the meaning)*
feeding level for an organism in a food chain;
naming of habitat *[1 mark]*
naming three trophic levels correctly *[1 mark]*
three examples forming a food chain from the named habitat *[1 mark]*
- (b) *(Award [1 mark] for any of the below, up to [9 marks])*
food types needed throughout life are the same;
proteins, carbohydrates and fats needed;
minerals and vitamins needed;
amounts of each that are needed vary / same diet not suitable;
young people are growing;
need adequate protein for tissue growth;
need adequate calcium for bone / teeth development;
old people are predisposed to cardiovascular disease;
need less saturated fats / cholesterol in diet;
need more fibre / roughage to promote bowel regularity;
sick people have activated defence systems;
need more protein to produce various phagocytic cells;
need more fluids to flush out metabolic waste / reduce fever;
young / active people are consuming more energy;
need additional fat / carbohydrates for fuel;
need additional protein for muscle fibre growth and replacement;
need additional water for loss from perspiration;
pregnant women are sustaining an embryo / need a different diet;
need more protein for tissue formation;
need more vitamin D for calcium absorption / bone / teeth development;
need more iron for foetal haemoglobin;
lactating women are providing nourishment / need a bigger diet;
need more calcium for milk production;
need more vitamin D for calcium absorption;
women need more iron because of menstruation *[9 max]*
- (c) the environment can only support a certain maximum population;
this population is sometimes exceeded (due to overproduction of offspring);
food / space / resources are insufficient / competition for resources;
some individuals fail to obtain enough;
deaths / failure to reproduce / survival of the fittest;
population falls to carrying capacity;
reference to evolution by natural selection; *[5 max]*

5. (a) *(Award [1 mark] for each of the following, up to [3 marks])*

energy source / respiratory substrate;
energy storage;
heat insulator;
buoyancy for aquatic animals;
protection around organs;
waterproofing material (as oils) in skin, feathers;
in cell membranes as phospholipids / as a lipid bilayer;
in plant scents (as fatty acids);
in bee honeycombs (as waxes);
(steroid) hormones;

[3 max]

(b) *(Award [1 mark] for each of the following, up to [6 marks])*

ATP synthetase / ATPase in the inner mitochondrial membrane / cristae;
 H^+ / proton gradient across the membrane;
higher concentration in intermembrane space than matrix;
 H^+ / proton allowed through membrane down the gradient;
energy released as protons travel through;
energy used to produce ATP;
proton gradient generated by electron transport chain;
using energy released during electron transport;

[6 max]

(c) *(Award a maximum of [9 marks] to any answer, with or without a diagram)*

(Award [1 mark] for each of the following, up to [9 marks])

muscles contraction due to sliding filaments;
actin and myosin filaments slide over each other;
diagram / description of interdigitation of filaments;
action potential / stimulation causes calcium release in muscle fibres;
from the endoplasmic / sarcoplasmic reticulum;
calcium activates troponin;
troponin binds to tropomyosin / troponin and tropomyosin change shape;
tropomyosin moves exposing binding sites on actin;
myosin heads bind to actin / cross bridges formed between actin and myosin;
myosin heads / cross bridges push actin filaments (inwards);
myosin heads detach / cross bridges break;
myosin heads move back and reattach / ratchet mechanism;
ATP used (to break cross bridges);
actin and myosin overlap more;
sarcomere becomes shorter;
myofibril / muscle fibre consists of many sarcomeres;

[9 max]

6. (a) *(Award [1 mark] for the following; up to [4 marks] max)*

Use the following mark scheme for each of the examples:

name of use;

source of the enzyme(s);

chemical reaction catalysed by the enzyme;

advantage of using the enzyme;

[4]

For example:

yoghurt making;

Lactobacillus makes the enzymes;

lactose in milk converted to lactic acid;

acidity prevents other microbes from growing in the yoghurt so preserving it;

- (b) *(For the first graph, which may be either exothermic or endergonic, award up to [1 mark] for any of the following, up to [4 marks])*

vertical axis with energy label and horizontal axis with time label;

labels showing reactant / substrate and product;

labelled line showing correct shape of curve without enzyme;

labelled line showing correct shape of curve with enzyme;

labels for activation energy with and without enzymes;

(Award [1 mark] for a second graph which shows the correct curves for an endergonic reaction if the first graph was exothermic or vice versa. For the second graph, no marks will be awarded for labels)

[5 max]

- (c) *(Award [1 mark] for any of the following, up to [9 marks])*

DNA molecule is double (stranded);

hydrogen bonds linking the two strands are weak / can be broken;

DNA can split into two strands;

split by helicase;

moves progressively down the molecule;

backbones are linked by covalent / strong bands;

strands do not therefore break / base sequence conserved;

reference to semi-conservative replication;

base pairing / sequences are complementary;

A - T and C - G;

the two original strands therefore carry the same information;

the two new strands have the same base sequence as the two original ones;

the strands have polarity;

base / nucleotides added in 5' - 3' direction;

the two strands have opposite polarity;

discontinuous segments / Okazaki fragments added to one strand;

DNA - ligase needed to connect the segments;

[9 max]

7. (a) *(Award [1 mark] for each structure not found in the other group, up to [5 marks])*

bryophytes have a thallus;
bryophytes have rhizoids;
bryophytes contain archegonia and antheridia;
bryophytes have sperm;
bryophytes main plant is a gametophyte;
angiospermophytes have a (complex) vascular system / xylem / phloem;
angiospermophytes have a cuticle / bark on their surface;
angiospermophytes have lignified tissues;
angiospermophytes have flowers;
angiospermophytes grow pollen tubes / produce pollen;
angiospermophytes have (enclosed) seeds / fruits;
angiospermophytes have roots / stems / leaves;
angiospermophytes main plant is a gametophyte

[5 max]

- (b) *(Award up to [4 marks] according to this scheme)*

[1 mark] for human activity;
[1 mark] for name of impact;
[1 mark] for mechanism of impact;
[1 mark] for environmental change;

[4 max]

An example might be:

electric power production causing

air pollution through

*sulphur dioxide emission from coal-burning power plants leading to acid rain
which can acidify freshwater lakes killing aquatic organisms.*

- (c) *(Award [1 mark] for any of the following, up to [9 marks])*

chromosomes arrange themselves in homologous pairs (synapsis);
tetrads / bivalents are formed;
connected at points called chiasmata where;
exchange of chromatid segments / crossing over between two homologues;
caused a recombination of the genetic material of the two homologues;
positions of chiasmata are random;
random assortment / orientation of bivalents;
in metaphase I;
with respect to which paternal or maternal homologue is on either side;
causing many possible combinations of parental chromosomes in daughter cells / gametes;
 2^n possible combinations;
in humans the number of possible combinations is 2^{23} / over 8 million;
homologous pairs separate / segregate in anaphase I;
dominant / recessive traits in gene pairs of homologues go to opposite poles;
only one of a pair of traits will finally be in a single gamete;
meiosis results in haploid cells;
therefore fertilisation is possible;
variation from random fertilisation;

[9 max]